Result of A National Survey: Time for Canada to Join The Global Research on Boron Neutron Capture Therapy?

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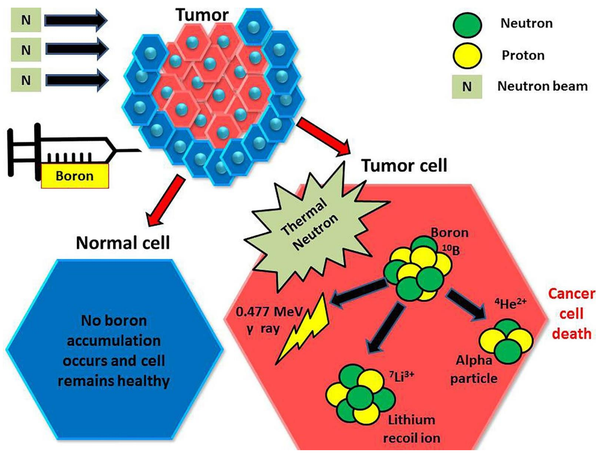
Background

- **Boron Neutron Capture Therapy (BNCT) is an emerging innovative cancer treatment.**
- BNCT's advantage is its selectivity to cancer cells.
- Its efficacy depends on higher boron concentrations in tumor than normal cells and neutron beam energy characteristics.
- Technological advancements in neutron sources has shifted reliance from nuclear reactors towards accelerator-based neutron sources, allowing for accessible and feasible study of BNCT.
- BNCT has been studied in glioblastoma, head & neck cancer, melanoma, and meningioma, with previous/ongoing studies suggesting promising results.
- Japan became the 1st country to gain approval for clinical use of BNCT for recurrent head & neck cancers in 2020.
- **There is a need for large-scale clinical trials to support evidence-based clinical application of BNCT.**
- There are ongoing efforts to develop an accelerator-based BNCT (AB-BNCT) center in a Canadian hospital: Canada Foundation for Innovation (CFI) 2023 Innovation Fund.
- **However, it remains unclear how Canadian radiation oncologists (RO), medical physicists (MP), and their residents perceive BNCT.**



Malouff, T. D., et al. (2021). Frontiers in oncology. doi.org/10.3389/fonc.2021.601820

Objectives

Our objective was to study Canadian RO, MP, and their residents':

1. ***Knowledge*** of history and recent developments of BNCT;
2. ***Interest*** in initiating Canadian efforts in BNCT research;
3. **Understanding and recognition** of BNCT's ***potential clinical applications***

Methods

1. After literature review, a survey was created with 17 questions. Respondents were able to offer additional responses to some questions.
2. Survey distribution was during January-May 2022 via 2 national organizations:
   - Canadian Association of Radiation Oncology (CARO)
   - Canadian Organization of Medical Physicists (COMP)
3. This study has been approved by the Windsor Regional Hospital Research Ethics Board as well as the Board of Directors of both CARO and COMP.
4. Data was analyzed using descriptive statistics.

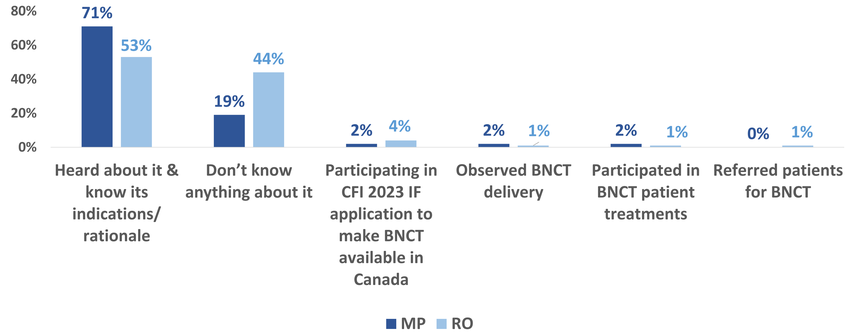
Conclusions

- **With recent technological advancements in accelerators, there is renewed global interest in BNCT research.**
- **Most Canadian radiation oncologists and medical physicists are aware of BNCT, support Canadian research efforts, and recognize the possible applications of BNCT.**
- **However, a large subset of physicians would benefit from education surrounding BNCT development and applications.**

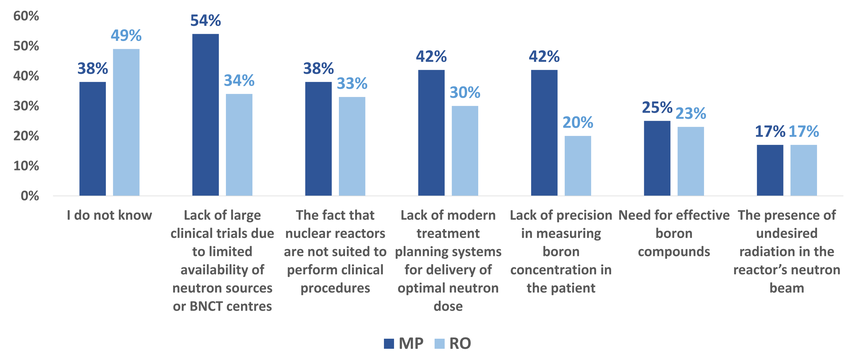
Demographics

- **118 valid responses** from **all 10 provinces** in Canada.
  - Majority from Ontario 46% (N=54) followed by Quebec 19% (N=22).
- **70 RO (59%), 48 MP (41%),** including 9 residents.

Current Knowledge of BNCT (MP vs RO)



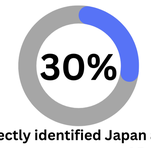
Perceptions on Reasons of Unsuccessful Early BNCT Studies Between 1950s-2000 in Nuclear Reactors



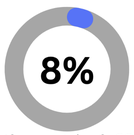
Recognition of BNCT in RO's Treatment Recommendations (N = 70)

- Hypothetical cases of recurrent & unresectable tumors following maximal dose chemoradiation.
- Out of 7 listed treatment options, BNCT was the 6th most rated option for glioblastoma (17%; N=12), meningioma (16%; N= 11), and melanoma cancers (16%; N=11).
- For head and neck cancers, BNCT was the least popular option (19%; N= 13).

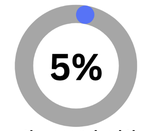
Awareness of Recent BNCT Developments



Correctly identified Japan as the 1st country to approve AB-BNCT for routine use in head & neck cancer in 2020

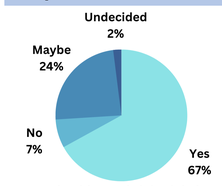


Correctly recognized ~20 BNCT facilities being built globally (2021)

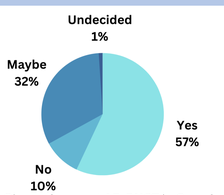


Correctly recognized that 20 countries sent representatives to attend the last BNCT Technical Meeting at IAEA to update the BNCT guideline book in 2020.

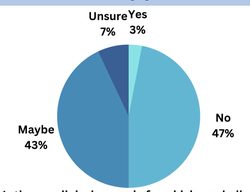
Opinions on Joining BNCT Global Research & Clinical Applications



Should Canada join global research efforts towards approving BNCT as a clinical technique?



Given a low-cost AB-BNCT in Canada, if you had a cancer patient who failed all other treatments, would you refer for BNCT clinical trials?



Is there a clinical scenario for which you believe there is a standard indication for BNCT? (RO only; N=70)

Additional Comments (Optional)

Limited awareness:
"I know next to nothing about BNCT. It would be great to see some talks on the subject at the next COMP meeting"

Considerations:
"This will require institutions [capable of] large scale clinical trials support, such as those located in regions of large patient populations."

Hesitations:
- "I'm worried about investing time and effort in developing a technique that hasn't received substantial uptake despite decades of existence"
- "I am prepared to keep an open mind, but I would need convincing to put research dollars into this enterprise"

Enthusiasm:
- "I think we should move forward with BNCT, often the introduction of a new technique serves as a catalyst for new discoveries"
- "We have knowledge, the resources, and clinical science background. We should move forward"

Discussion

1. **Knowledge** of BNCT:
   - Despite **some awareness** (60% total), many RO (44%) **don't know about BNCT.**
   - Despite 49% RO and 38% MP **not knowing reasons** for lack of BNCT progress, many believe it's most attributable to **limited trials** due to neutron source inaccessibility (42%) and **infrastructure** unsuitability (35%).
   - **Limited awareness** (5-30%) of recent BNCT global developments
2. Prevalent support (67%) for initiating Canadian BNCT research contributions.
3. BNCT's potential **clinical applications in Canada:**
   - Recognition of BNCT as a possible **recommended treatment** (16-19% of RO).
   - 57% of RO/MP willing to refer or recommend

***For details please visit:** https://doi.org/10.3390/cancers15143626

Acknowledgments

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CARO Canadian Association of Radiation Oncology
ACRO Association canadienne de radio-oncologie
MACH-GAENSSLEN Foundation of Canada
COMP Canadian Organization of Medical Physicists
OCPM Organisation canadienne des physiciens médicaux